

A COMPARISON  
OF THE RESULTS OF TREATMENT OF ANKYLOSTOMIASIS  
WITH VARIOUS DRUGS.

by

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The investigations on which this thesis is based were carried out during a period of about a year and a half when I was in charge of the United Free Church of Scotland Mission Hospital at Uburu, Southern Nigeria. The hospital is situated in a comparatively thickly populated area amongst primitive natives of the Ibo tribe.

A new-comer is at once struck with the poor physique of the natives and their disinclination and inability for hard work. There is no doubt that the ankylostome is responsible for a large part of this condition, and when the habits of the people are considered it is not surprising that the infection is universal. Sanitation simply does not exist. Any more or less retired spot is used for defaecation; sandals or boots are unknown; and during the dry season contaminated water from stagnant pools is used for drinking purposes.

An examination of the faeces of a number of apparently normal persons - including hospital orderlies and mission labourers - showed that the ankylostome was present in every case. Wyler in a paper published in "the Journal of Tropical Medicine and Hygiene" July 1, 1913, reports that he examined the/

the faeces of 200 convicts at the prison at Udi (only some fifty miles from my hospital) and found ova in 199 cases; the exception being an educated man who had worn boots for many years.

But in addition to causing this general lowering of condition the ankylostome is responsible for a large amount of real sickness. As A.E. Boycott says in the Milroy Lectures, 1911:-

"Taking the world as a whole, with the possible exception of the malarial organisms, ankylostoma is, I suppose, responsible for more unhappiness and inefficiency than any other parasite, and, for the most part indirectly, for no inconsiderable number of deaths. Practically all tropical countries are permeated with the worm, and in places where the conditions for its propagation are not unfavourable it may reduce four-fifths of the population to a continual state of chronic ill-health which is only terminated by their premature decease, commonly from some secondary infection".

In Nigeria nothing has yet been attempted in the way of mass treatment of the population with anthelmintics as has been done in other parts of the world, notably in Egypt, and owing to the backwardness of the people the time for this on a large scale is probably not yet ripe.

A large number of patients consulted me complaining/



complaining of symptoms which could not be traced to any cause other than the ankylostome and, in referring to text books on the subject, I was struck with the variety of drugs recommended and the varying success which different physicians obtained with them. After considering the matter, I came to the conclusion that possibly the types of the parasite might vary in different localities in their powers of resistance to anthelmintics. Thus in parts of India Chenopodium oil has been found superior to thymol; in Natal eucalyptus mixture has given excellent results; and in Borneo carbon tetrachloride is preferred. Similarly betanaphthol, santonin, antimony tartarate, thymol, magnesium sulphate and quassia, pelletterine tannate, izal and autogenous vaccines all have their advocates.

Accordingly I decided to find out by experiment which drug was most effective in the cases with which I had to deal. In doing so I had in mind not only the cases complaining of definite illness, but also the possible mass treatment in the future of the population of the district when it would be a great advantage to know definitely the most generally useful drug.

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SYMPTOMS AND SIGNS.

The cases included in this investigation were all young adults and the symptoms complained of were in all cases the same and were quite typical. The symptoms were headache, general weakness and epigastric pain. In many cases bilateral earache and tinnitus were prominent complaints. Oedema of the feet was only occasionally present but a large number of patients showed the characteristic puffy face.

As far as possible the cases selected were of the same degree of severity, and very advanced cases with great prostration, fever and marked oedema were not included.

In very few cases could the typical "ground itch" be discovered, but in many there was found an itching eruption on that part of the buttocks and thighs which in squatting and reclining would be in contact with the ground which some authors have considered may be a site of entry of ankylostome infection.

The degree of anaemia found to be present was lower than might have been expected. In nearly all the cases the percentage of haemoglobin (as roughly estimated by Tallqvist's method) was over 65 and in only/

only two cases was it below 50. This is an interesting contrast to the figures for Porto Rico where about half the agricultural population (about 300,000) have had 50% or less haemoglobin.

Eosinophilia and poikilocytosis were observed in blood films in the majority of cases. Circulatory changes were not often present; bruits and cardiac dilatation were noted occasionally.

#### DIAGNOSIS.

Only those cases are included in which, after thorough examination, the symptoms could not be ascribed to any cause other than ankylostomiasis, particular care being taken to exclude tuberculosis. The diagnosis was invariably confirmed by microscopic examination of the faeces. It may here be noted that for the purposes of this investigation, for diagnosis and for a test of cure, the microscopic detection of ova was preferred to the naked eye detection of the worms and was found more satisfactory.

Clayton Lane's levitation method of concentration was used, the technique being as follows:- a measured half c.c. of faeces was transferred to a wide test tube which was four-fifths filled with filtered water and thoroughly shaken, and strained through/



through gauze. The filtrate was then centrifuged in a tube fitted with a cork. The sediment found on the cork when this was removed was washed on to a watch glass and spread on slides - two of which were thoroughly examined in each case before a negative report was given. The slides were prepared under my supervision by a native dispenser.

Both *ankylostoma duodenale* and *neator americanus* were found - very frequently together, but sometimes alone. In about twenty per cent. of cases *ascaris lumbricoides* was also present.

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GENERAL TREATMENT.

The cases referred to in this thesis were all treated as in-patients as it was found impossible to treat patients efficiently unless the administration of the drugs was under the control of a trained attendant.

The following details of treatment were carried out in every case.

- (a) The patient was admitted to hospital two days before the first anthelmintic was administered; during this time he was confined - as far as possible - to bed.
- (b) On the day before treatment only light food was allowed, and no food at all after mid-day.
- (c) On the evening before treatment two ounces of Magnesium Sulphate were given.
- (d) On the day on which the anthelmintic was given the patient was kept lying down and precautions observed that he took no food until evening when a light meal was allowed, from which oils and fats were excluded.
- (e) On the following days the patient was encouraged to rest in the fresh air and to take plenty nourishing/



nourishing food. The bowels were regulated and a mixture containing 10 minims of Liquor Ferri Perchlor. and 2 minims of Liquor Arsenicalis was given three times a day.

- (f) The faeces were examined on the eighth day after the administration of the anthelmintic.
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ANTHELMINTICS EMPLOYED,THEIR DOSE AND METHOD OF ADMINISTRATION.

Liquid extract of filix mas, in  $1\frac{1}{2}$  drachm doses in combination with 45 minims of ether, and antimony tartarate in  $1/6$  grain doses were tried in a few cases but with unsuccessful results.

The following six drugs and combinations were given each to fifteen cases.

- (a) Thymol:- 90 grains in three doses of 30 grains each at intervals of two hours; two ounces of magnesium sulphate being given four hours after the last dose. The drug was given in mixture with mucilage of tragacanth and one drachm of sodium bicarbonate. Smaller doses (40 and 60 grains) of thymol were tried but the results were unsatisfactory.
- (b) Eucalyptus Mixture:- The mixture as recommended by Manson consisted of 30 minims of eucalyptus oil, 45 minims of chloroform and 2 ounces of castor oil. One half was given first thing in the morning and the other half thirty minutes later. One ounce of magnesium sulphate was given four hours later.

(c)/

- (c) Betanaphthol:- 60 grains in three doses of 20 grains each at intervals of 2 hours, given in mixture with mucilage, and followed four hours later by two ounces of magnesium sulphate.
- (d) Chenopodium Oil:- 45 minims in three doses of 15 minims on a lump of sugar at intervals of two hours followed by 45 minims of chloroform and two ounces of castor oil three hours after the last dose.
- (e) Carbon Tetrachloride:- one drachm of the chemically pure drug was given first thing in the morning, and four hours later two ounces of magnesium sulphate.
- (f) Thymol and Betanaphthol:- A mixture was made consisting of 90 grains of thymol, 60 grains of Betanaphthol and 60 grains of sodium bicarbonate with mucilage and water. This was given in three equal doses at intervals of two hours, the last dose being followed four hours later by two ounces of magnesium sulphate.

Undesirable symptoms following administration of these drugs were rarely seen. Headache and nausea were fairly frequently complained of, especially after carbon tetrachloride, but serious symptoms occurred/



occurred in only one case - a patient who took food immediately after receiving his last dose of thymol and suffered from collapse. This is in marked contrast to the experience of some authors e.g. Burton Nicol in the "Journal of Tropical Medicine and Hygiene" January 1, 1912, says "The ninety grain thymol treatment causes very serious constitutional disturbance. The individual is at first excited and talkative, the pulse and respiratory rates are quickened. Subsequently dizziness and drowsiness are complained of, the pulse becomes quick and compressible and if the patient is not kept in a recumbent position alarming degrees of excitement or of syncope may be seen".

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RESULTS OF TREATMENT.

The tables which follow show the results of treatment by the various drugs used. The second faeces examination was made eight days after the first treatment; if ankylostome ova were found (indicated by +) a second treatment was given on the following day (i.e. nine days after the first treatment). Similarly the third faeces examination was made eight days later (i.e. on the seventeenth day) and if positive a third treatment was given on the following day, the fourth faeces examination being made after eight days (i.e. on the twenty sixth day).

It may be noted here that the clinical results of treatment were closely related to the laboratory findings. Thus after a fortnight's treatment most patients were greatly improved in health even although ova were still present in the faeces, but they were not relieved of all their symptoms until the stools were clear. Cases in which ova were absent at the second faeces examination improved in a remarkable way; the headache and epigastric pain disappeared in a few days and they were fit for hard work in a very short time.

Steps were taken to prevent re-infection;  
sanitary/

sanitary rules were rigorously enforced and rain water (collected in tanks from the corrugated iron roofs of the hospital buildings) was used for drinking and washing purposes.

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PARTICULARS OF 15 CASES TREATED FIRST WITH EUCALYPTUS MIXTURE.

Number of Case	Result of Second faeces Examination	Second Treatment	Result of Third faeces Examination	Third Treatment	Result of Fourth faeces Examination
1.	-				
2.	+	Eucalyptus	+	Eucalyptus	+
8.	+	Eucalyptus	+	Thymol and B. naphthol	-
9.	-				
19.	-				
20.	+	Thymol and B. naphthol	-		
21.	+	Eucalyptus	-		
57.	+	Eucalyptus	+	Eucalyptus	-
58.	+	Eucalyptus	+	Thymol	-
59.	+	Eucalyptus	+	Eucalyptus	-
60.	-				
61.	+	Ol. Chenopod.	+	Thymol B. naphthol	-
62.	+	B. naphthol	+	Thymol B. naphthol	-
63.	+	Eucalyptus	+	Eucalyptus	+
64.	+	Carbon tetra- chloride	+	Thymol B. naphthol	-

PARTICULARS OF 15 CASES TREATED FIRST WITH BETANAPHTHOL.

Number of Case	Result of Second faeces Examination	Second Treatment	Result of Third faeces Examination	Third Treatment	Result of Fourth faeces Examination
7.	+	Betanaphthol	+	Betanaphthol	-
10.	+	Thymol	+	Thymol B.naphthol	-
11.	-				
22.	+	Betanaphthol	+	Betanaphthol	+
23.	+	Betanaphthol	+	Thymol Betanaphthol	-
24.	-				
46.	+	Eucalyptus	+	Thymol B. naphthol	-
47.	-				
48.	+	Betanaphthol	-		
49.	+	Carbon Tetra- chloride	-		
50.	+	Carbon Tetra- chloride	+	Thymol B.naphthol	-
51.	-				
52.	+	Ol. Chenopod.	+	Ol. Chenopod.	-
53.	+	Thymol B.naphthol	-		
55.	+	Thymol B.naphthol	-		

## PARTICULARS OF 15 CASES TREATED FIRST WITH CARBON TETRACHLORIDE.

Number of Case	Result of Second faeces Examination	Second Treatment	Result of Third faeces Examination	Third Treatment	Result of Fourth faeces Examination.
3.	+	Carbon Tetra- chloride	-		
6.	-				
16.	-				
17.	+	Carbon Tetra- chloride	+	Carbon Tetra- chloride	-
19.	+	Thymol B. naphthol	-		
33.	-				
34.	+	Carbon Tetra- chloride	-		
35.	+	Ol. Chenopod.	+	Thymol B. naphthol	-
36.	+	Carbon Tetra- chloride	+	Carbon Tetra- chloride	+
54.	-				
56.	-				
88.	-				
89.	+	Thymol B. naphthol	-		
90.	-				
37.	-				



PARTICULARS OF 15 CASES TREATED FIRST WITH CHENOPODIUM OIL.

Number of Case	Result of Second faeces Examination	Second Treatment	Result of Third faeces Examination	Third Treatment	Result of Fourth faeces Examination
13.	-				
14.	+	Ol. Chenopod.	+	Ol. Chenopod.	-
15.	+	Ol. Chenopod.	-		
29.	-				
30.	-				
31.	-				
65.	-				
66.	+	Thymol B. naphthol	-		
67.	-				
73.	+	Thymol B. naphthol	+	Thymol B. naphthol	-
74.	-				
75.	+	Ol. Chenopod.	-		
76.	+	Thymol B. Naphthol	-		
77.	-				
78.	-				

PARTICULARS OF 15 CASES TREATED FIRST WITH THYMOL.

Number of Case	Result of Second faeces Examination	Second Treatment	Result of Third faeces Examination	Third Treatment	Result of Fourth faeces Examination
4.	-				
12.	-				
25.	-				
26.	+	Thymol	+	Thymol B. naphthol	-
27.	+	Thymol	-		
29.	-				
32.	-				
38.	+	Thymol B. naphthol	-		
39.	-				
40.	-				
41.	-				
42.	+	Betanaphthol	+	Thymol B. naphthol	-
43.	-				
44.	+	Thymol	+	Thymol	-
45.	-				

PARTICULARS OF 15 CASES TREATED FIRST WITH THYMOL AND BETANAPTHOL.

Number of Case	Result of Second faeces Examination	Second Treatment	Result of Third faeces Examination
5.	-		
68.	-		
69.	-		
70.	-		
71.	+	Thymol B. naphthol	-
72.	-		
79.	-		
80.	-		
81.	-		
82.	-		
83.	-		
84.	-		
85.	-		
86.	-		
87.	-		



SUMMARY OF ABOVE TABLES.COMPARISON OF RESULTS OF FIRST TREATMENT.

Treatment	Number of cures at first treatment.	Percentage of cures at first treatment.
Eucalyptus mixture	4	27
Betanaphthol	4	27
Carbon Tetrachloride	8	53
Chenopodium Oil	9	60
Thymol	10	67
Thymol and Betanaphthol	14	93

While it is realised that the number of cases treated is too small to admit of wide generalisations yet I feel that these results are sufficiently striking to merit certain conclusions. The superiority of the combination of thymol with betanaphthol as a first treatment seems established with fourteen cures out of fifteen cases treated. Moreover, the way in which this mixture cured cases which had failed to react to other drugs was remarkable. In this connection an interesting case is recorded by Phippen of Zanzibar in the "British Medical Journal" March 3rd, 1923, p.371. He states "After thirty-two thymol and three eucalyptus treatments ova were still present; the case was negative after treatment with betanaphthol and thymol".

#### COMPARISON WITH RESULTS RECORDED IN LITERATURE.

A number of authors have recorded the results of treatment of ankylostomiasis. It is not easy to compare these results as some calculate on the basis of the percentage of worms removed; thus the Rockefeller Commission states that after the 90 grain thymol treatment 97.8% of adult worms are removed. The following notes, however, on the percentage of cures at the first treatment, as revealed by absence of ova from the faeces, are of interest.

Eucalyptus Mixture:-

Burton Nicol (Natal) "Journal of Tropical Medicine  
and Hygiene" Jan. 1st 1912, p.1 74.2 per cent

My cases . . . . . 27 per cent

Betanaphthol:-

Porto Rico Commission, 1905 report  
(using 45 grains) . . . . . 72.2 per cent

My cases . . . . . 27 per cent

Carbon tetrachloride:-

Grandsoult (British Guiana) "British  
Medical Journal" Feb. 23rd, 1924,  
p.319 . . . . . 40 per cent

My cases . . . . . 53 per cent

Chenopodium Oil:-

Clayton Lane (India) "American Journal  
of Tropical Medicine" Vol.2, 1922,  
p.397 . . . . . 93 per cent

My cases . . . . . 60 per cent

Thymol:-

Wyler (Nigeria) "Journal of Tropical  
Medicine and Hygiene" July 1st,  
1913, p.193 . . . . . 90 per cent

My cases . . . . . 67 per cent

Thymol and Betanaphthol:-

Phippen (Zanzibar) "British Medical  
Journal" Mar. 3rd, 1923, p.371. 34.5 per cent

My cases . . . . . 93 per cent



SUMMARY OF THESIS.

The results are recorded of the treatment of ninety cases of ankylostomiasis - fifteen with each of six anthelmintics commonly recommended. These results show that the combination of thymol with betanaphthol is the most efficient method of treatment of the cases met with in this part of Nigeria.

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